CANNULA DELIVERY AND SUPPORT SYSTEM

Inventor(s):
CARLOS A. GUANCHE

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to anchor and anchoring systems for securing arthroscopic or laparoscopic cannulas within puncture openings in the skin and more particularly to a flexible coil to be secured to the cannula device after being inserted through the puncture opening.

2. Description of the Related Art

[0002] Arthroscopic or endoscopic surgery is that surgery performed through minimally-invasive means, through limited incisions. The areas that are approachable by these techniques include any synovial joint; the abdominal and thoracic cavities; the mediastinum, epidural, pleural and subarachnoid spaces; heart ventricles and spinal cavities.

[0003] These endoscopic procedures provide a minimally invasive approach to many surgical procedures previously performed through traditional means. In the traditional approaches, surgery was performed by making a large incision over the area, followed by an exposure of the area in question by retracting or incising the soft tissues between the skin and the necessary area. In endoscopic surgery, a small puncture is made in the skin and a series of instruments are inserted by way of cannulas directly into the area. The cannula devices that are employed are usually tubular in shape and are of various sizes. Many have serrations, protruberances or threads at their tips (US 5,217,441), in order to stabilize them in the soft tissues. None of the available designs, however, are effective in maintaining the cannula in proper position.

[0004] The reason for the lack of stability is that most commonly there is a medium that is used to distend the space. In the abdominal and thoracic cavities, it is CO_2 gas; while in joints, it is saline solution. These materials cause the tissues to deform, subsequently allowing the cannula devices to move out of their original positions. The most common problem is that of having to re-insert the device back through the previously made tract. This becomes increasingly difficult with the use of more gas or fluid for distention.

[0005] There are several devices available that attempt to improve the stability of the cannula devices. One such example is US 6,542,283 (Hopper), in which a universal balloon anchor is employed for stabilization of the cannula device. The complexity of the device, however, precludes its common employment as a result of its prohibitive price.

[0006] Many other devices are available that attempt to improve stability of the cannula by

incorporating the stabilizing elements into the cannula. Some examples are US 5,637,097 (Yoon), US 5,197,971 (Bonutti), US 5,002,557 (Hasson) and US 5,882,340 (Yoon). All of these, while perhaps stabilizing the devices nicely, are not commonly employed as a result of their prohibitive cost, compared to the standard cannula devices currently available.

SUMMARY OF THE INVENTION

[0007] In a broad aspect, the present invention is a cannula supporting coil that comprises a thin resilient elongated member having a proximal portion; an intermediate portion; and, a distal portion. The proximal portion of the thin resilient elongated member comprises a clip portion for capturing a side port of an endoscopic or arthroscopic cannula. The distal portion has a plurality of revolutions to accommodate the main body of the cannula. A terminal portion of a final revolution of the distal portion has less curvature than previous portions of the distal portion for anchoring to an anatomical cavity lining of an anatomical cavity.

[0008] In another broad aspect the present invention is a cannula delivery and support system that includes the cannula supporting coil discussed above, an elongated sheath for containing said cannula supporting coil during delivery of the cannula supporting coil to the anatomical cavity; and an elongated trocar. An upper portion of the trocar has a diameter slightly smaller than an inner surface of the elongated sheath. A lower portion has a diameter less than the revolutions of the distal portion of the cannula supporting coil so as to maintain the revolutions of the distal portion of the cannula supporting coil about the lower portion. The lower portion terminates in an atraumatic end.

[0009] The lower portion of the trocar, the sheath, and the cannula supporting coil are introduced into the anatomical cavity as a single unit, the trocar being removed and inverted so that the upper end thereof is utilized as a plunger to push the cannula supporting coil toward a lower end of the elongated sheath thus allowing removal of the sheath to allow placement of the cannula supporting coil and subsequent placement of the cannula.

[0010] The present invention is an improvement over the prior art in that it provides for a flexible device that is inserted prior to insertion of the cannula device, then locks onto the side portal of the cannula and stabilizes it. The device is universal in its ability to support many varieties of cannulas that are inserted into body spaces.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Figure 1 is a perspective view of the cannula supporting coil of the present invention.

[0012] Figure 2 is a perspective view of the cannula supporting coil in place around an arthroscopic

cannula.

[0013] Figure 3 is a perspective view, partially in phantom, of the cannula delivery and support system of the present invention.

[0014] Figure 4 is a perspective view, partially in cross-section and in phantom, of the cannula delivery and support system positioned in a joint space.

[0015] Figure 5 is a partially cutaway side perspective view showing the advancement of a cannula supporting coil into the joint space by use of a plunger portion of the trocar.

[0016] Figure 6 is a partially cutaway side perspective view of the cannula supporting coil in position within a joint.

[0017] Figure 7 is a schematic illustration of the clip portion of the cannula supporting coil being positioned over a side port of the cannula.

[0018] Figure 8 is a schematic illustration of a cannula positioned within a cannula supporting coil, with the clip portion in place on a cannula side port.

[0019] Figure 9A is a perspective view of an alternate trocar.

[0020] Figure 9B is an end view of the trocar of Figure 9A.

[0021] Figure 10 is a side perspective view showing the advancement of a cannula supporting coil within the cannula by use of the trocar of Figures 9A and 9B.

DETAILED DESCRIPTION OF THE INVENTION

[0022] Referring now to the drawings and the characters of reference marked thereon, Figure 1 illustrates a preferred embodiment of the cannula supporting coil the present invention, designated generally as 10. The cannula supporting coil 10 comprises a thin resilient elongated member including a proximal portion 12, an intermediate portion 14 and a distal portion 16. The proximal portion 12 includes a clip portion 18 for capturing a side port of an endoscopic or arthroscopic cannula. The clip portion 18 may comprise a loop of the elongated member. The distal portion 16 preferably has a plurality of revolutions to accommodate the main body of the cannula. There are generally about 2-5 revolutions, preferably about three. A terminal portion 20 of a final revolution of the distal portion 16 has less curvature than previous portions of the distal portion 16 for anchoring to an anatomical cavity having an anatomical cavity lining. It is preferably straight to assure its purchase in tissues.

[0023] The cannula supporting coil 10 is preferably formed of a metal wire such as nitinol, a shape memory alloy. Nitinol exhibits a unique phase transformation in the crystal structure when transitioning between the austenite and martensite phases. The austenite phase is the high temperature, stronger state compared to the weaker, low temperature martensite phase. Nitinol is comprised mostly of nickel and titanium, and usually alloyed with various other metals. It is the

most common shape memory alloy; however, numerous alloys behave in a similar fashion. Alternatively, other resilient materials may be used such as plastic that have the ability to maintain the desired configuration. The coil 10 preferably has a diameter in a range of 1-5 mm, most preferably about 2 mm. It may be, for example, about 90 mm long and have rounded (or smooth) tips. The length, L1, of the sum of the proximal and intermediate portions 12,14 may be, for example, about 70 mm. The length, L2, of the distal portion 16 may be about 25 mm.

[0024] Referring now to Figure 2, the cannula supporting coil 10 is shown in place about a cannula 22, as will be described in more detail below. The clip portion 18 of the cannula supporting coil 10 is wrapped around a side port 24 of the cannula 22. The distal portion 16 of the cannula supporting coil 10 anchors to an anatomical cavity lining.

[0025] Referring now to Figure 3, the entire cannula delivery and support system, designated generally as 26, is illustrated. The cannula delivery and support system 26 includes the cannula supporting coil 10, an elongated sheath 28, and an elongated trocar 30. The elongated sheath 28 contains the cannula supporting coil 10 during delivery of the cannula supporting coil 10 to the anatomical cavity. The elongated trocar 30 has an upper portion 32 and a lower portion 34. The upper portion 32 has a diameter slightly smaller than an inner surface of the elongated sheath 28. The lower portion 34 has a diameter less than the revolutions of the distal portion of the cannula supporting coil 10 so as to maintain the revolutions of the distal portion 16 of the cannula supporting coil 10 about the lower portion 34. The lower portion 34 terminates in an atraumatic end 36. The elongated sheath 28 is preferably formed of metal or plastic.

[0026] In operation, an incision is made in the skin of a patient. The incision is utilized for inserting the cannula delivery and support system 26 into an anatomical cavity. As can be seen in Figure 4, the incision in the skin 38 is used to insert the cannula delivery and support system 26 into the soft tissue 39 between the skin 38 and the anatomical cavity 40 which is surrounded by the cavity lining 42. The system 26 includes the elongated sheath 28 that contains the cannula supporting coil 10. It also includes the elongated trocar 30. Elongated trocar 30 sits within the elongated sheath 28, so that, as noted above, the revolutions of the distal portion 16 of the cannula supporting coil 10 are maintained about the lower portion 34 of the trocar 30. The edges of the sheath 28 should preferably have slightly tapered edges to prevent catching through tissues.

[0027] Referring now to Figure 5, once the cannula delivery and support system 26 is in the cavity 40 the trocar 30 is pulled out and inverted. The trocar 30 is then reinserted into the elongated sheath 28 in the inverted position so that the upper end 32 thereof is utilized as a plunger to push the cannula supporting coil 10 toward a lower end of the elongated sheath 28 so that the terminal portion 20 of the cannula supporting coil 10 is within the anatomical cavity 40.

[0028] As can be seen in Figure 6, once the cannula supporting coil 10 is in place with the distal portion in the joint, the elongated sheath 28 is removed leaving the cannula supporting coil 10

within the anatomical cavity 40 to the cavity lining 42.

[0029] Referring now to Figures 7 and 8, once the elongated sheath 28 is removed, the cannula 22 is inserted into the anatomical cavity 40 within the revolutions and the clip portion 18 of the cannula supporting coil 10 is inserted about the side port 24 of the cannula 22. The loop 18 is thus placed at about 90 degrees to the rest of the cannula. Alternatively, a locking sleeve can be applied circumferentially around the coil and cannula in order to stabilize the device (this can be as simple as steri-strips). This portion is variable as the design of many cannulas varies from one surgical discipline to another.

[0030] Figure 8 shows the cannula 22 positioned within the cannula supporting coil 10, with the clip portion 18 in place on the side port 24.

[0031] The present device/method may be useful in arthroscopic surgery of any joint, endoscopic surgery of the abdomen, pelvis, chest and mediastinum. It may be used in a synovial joint, thoracic cavity, epidural space, pleural space, subarachnoid space, heart ventricle, spinal cavity.

[0032] Other embodiments and configurations may be devised without departing from the spirit of the invention and the scope of the appended claims. For example, referring now to Figures 9A and 9B, another embodiment of the trocar is illustrated, designated generally as 42. The trocar 42 has an upper portion 44 with a truncated circular cross-section. This is preferably about ¾ of a circle.

[0033] Thus, in use, as can be seen in Figure 10, the trocar 42 is inverted. The space between the truncated portion 46 and the wall of the elongated sheath can accommodate the clip portion 18 of the cannula supporting coil 10. Therefore, the end of the trocar 42 engages only the distal portion of the cannula supporting coil 10. The coil 10 may be advanced without distorting the clip portion 18 of the coil 10.